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# THERMAL TRANSFER RECORDING MEDIA

T. Takei, M. Taniguchi, H. Fukushima, Y. Yamaguchi,
M. Shinozuka, K. K. Suwa Seikohsha

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16. Abstract

The title media consist of >1 coloring layer and a layer containing a flame retardant to exhibit noncombustibility and good thermal transfer. Thus, a PET film was coated on a side with a compn. contg. Vylon 290 (polyester resin). AFR-1021 (decabromodiphenyl oxide)8 and Polysafe 60 (Sb oxide) and coated on another side with a compn. contg. carnauba wax, ENP-9 (paraffin wax), EV-410 (ethylene-vinyl acetate copolymer), and Cu phthalocyanine to give a thermal-transfer recording medium which showed good noncombustibility and antiblocking properties and provided high quality images.

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T. Takei, M. Taniguchi, H. Fukushima, Y. Yamaguchi, M. Shinozuka
K.K. Suwa Seikohsha
3 chome 3 ban 5 go, Yamato, Suwa city

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72. Inventors: Katsumori Takei, K.K. Suwa Seikohsha, 3 chome 3 ban 5 go, Yamato, Suwa city

72. Inventors: Makoto Taniguchi, K.K. Suwa Seikohsha, 3 chome 3 ban 5 go, Yamato, Suwa city

72. Inventors: Hitoshi Fukushima, K.K. Suwa Seikohsha, 3 chome 3 ban 5 go, Yamato, Suwa city

72. Inventors: Yoshitaka Yamaguchi, K.K. Suwa Seikohsha, 3 chome 3 ban 5 go, Yamato, Suwa city

72. Inventors: Masakazu Shinozuka, K.K. Suwa Seikohsha, 3 chome 3 ban 5 go, Yamato, Suwa city

71 Applicant: Seiko Epson K.K. 2 chome 4 ban 1 go, Nishishinjuku, Shinjuku-ku, Tokyo

74. Representatives of the applicant: a patent attorney Tsutomu Mogami

## DETAILS

1. Name of Invention

Thermal Transfer Recording Media

2. Limit of the Patent Covered

(1) Thermal transfer recording medium which consists at least of color and fire retardation layers.

(2) Thermal transfer recording medium described in (1) above, whose fire retardation layer contains one or more of the following compounds A - D: A: halogen compounds, B: phosphorous ester compounds, C: halogenated phosphorous ester compounds, D: inorganic compounds.

(3) Thermal transfer recording medium whose fire retardation layer contains reactive fire retardation additives consisting at least of halogen or phosphor.

(4) Thermal transfer recording medium whose fire retardation layer contains 1-100 wt % of fire retardation compounds.

(5) Thermal transfer recording medium whose supporting layer has a fire retardation layer on one side and a color layer on the other side.

3. Interpretation of Invention

[Technical Field]

This invention is concerned with thermal transfer recording media utilized for a thermal transfer recorder.

[Previous Technology]

The thermal transfer recorder is small, cost effective, in a low noise, low power consumption, and colorized, and thus it is widely used for terminals of communications and information storage. The recording principle of the thermal transfer recorder is shown in Fig. 3. In Fig. 3, 301 is a thermal element and produces heat corresponding to the input signal, 302 is a thermal transfer recording medium, 304 in Fig. 3 in the medium is thermally activated by Joule heat of the thermal element, and 303 is a transfer medium. The thermally activated color materials

adhere to the medium, penetrate or diffuse into the transfer medium and a visible image is formed.

In Fig. 4, we display a composition of the thermal transfer record medium. In Fig 4. 401 is a supporting layer and 402 is a color material layer. The supporting layer is made of a condenser paper or a thermally resistant polymer film such as polyethylene terephthalate. The color layer is formed by coating pigments or dyes, and thermal plasticiser including 403 in Fig. 4 on the support.

[Problems to be Solved]

In traditional equipments, the color material layer and supporting layer consist of cellulose, thermal plasticiser polymer, or wax and, are flammable. Overheating during working conditions or catching fires during unattended caused recording media burn. There were also some fires and human injuries.

In order to reduce overheating, fire retardation compounds are often added to the supporting layer or the color layer. However, such additives in the color material layer lower the color density and contrast, and change rheological properties of the color material layer. The produced images are poor. On the other hand, if the additives are in the supporting layer, thermal and mechanical strengths of the supporting layer decrease and the recording is often interrupted.

Therefore, in order to solve these problems, this invention proposes that fire retardation compounds should be added to the thermal transfer recording medium. The proposed technique is new and superior to the traditional one.

[Techniques to Solve the Problems]

The proposed thermal transfer recording medium consists at least of color and fire retardation layers. Further, the thermal transfer recording medium described in (1) above, has a fire retardation layer which should contain one or more of the following compounds A-D: A: halogen compounds, B: phosphorous ester compounds, C: halogenated phosphorous ester compounds, D: inorganic compounds.

The fire retardation layer should also contain reactive fire retardation additives

containing at least halogen or phosphor. The fire retardation layer should contain 1 - 100 wt % of fire retardation compounds. The supporting layer has a fire retardation layer on one side and a color material layer on the other side.

[Working Condition]

According to our invention, the thermal transfer recording medium become fire retarded since the layer which contains fire retardation compounds is limited in the color or supporting layer; characteristics of each layer are not affected by an addition of additives. In other words, fire retardation compounds are added to the color material layer or supporting layer and thus the side effects of additives are avoided and the high quality image can be recorded.

Further, it is possible to add other superior qualities mentioned below. In the traditional method, the color material adheres the supporting body when it is stored in a roll form, which is called a blocking phenomenon. One of the solutions to this problem is to coat a blocking preventative layer on the support surface. The structure of a thermal transfer recording medium for this invention is shown in Fig. 1. A new layer (103 in Fig. 3) which contains fire retardation compounds is added to the one side of the supporting layer (101) opposite to the color layer (102). It functions just as the blocking preventative layer does.

[Experiment 1]

The thermal transfer recording media is shown in Fig. 1. We used as the supporting layer (101) a two axially elongated polyethylene terephthalate sheet of 4 μm thickness. The layer containing fire retardation additives (103) is formed in the following way:

A liquid, whose composition is described later, was coated on the supporting layer, and dried at 60°C for 24 hrs. The layer was 3 μm thick.

| Chemicals | Composition (wt%) |
|---|---|
| Toluene | 25 |
| Methylethylketone | 25 |
| Methyl isobutylketone | 25 |
| Polyester (viron 290 Toyo Boseki Co.) | 19 |
| Decarbromodiphenyl oxide (AFR 1021 Asaki Glass Co.) | 4 |
| Antimony oxide | 2 |

The color material layer (102) was made to be 3 $\mu$m by the hot melt method. The composition is given below :

| Chemicals | Composition (wt%) |
|---|---|
| Carnauba wax | 20 |
| Paraffin wax (NNP 9 Nippon Seirou) | 50 |
| Ethylene vinylacetate copolymer (EV 410 Mitsui polychemical) | 20 |
| Copper phthalocyanine | 10 |

Next we show our test results for combustion of the thermally transfer recording medium and for evaluation of the printed image. We evaluated the combustibility by use of the UL94MB method. The method of determining the quality of printed images is displayed in Fig. 2. In Fig. 2, 204 is the thermal transfer recording medium, one side of the supporting layer (201) is the color material layer (202) and the other side of the color material layer is a fire retardation compound layer (203). The thermal head (205), thermal transfer recording medium, and a transfer paper were placed as indicated in Fig. 2. The color materials were

transferred on the transfer paper by full pete, and color and density were measured. The thermal head was 180 DPI and the applied energy was 0.7 mJ/dot. In order to estimate the blocking, the recorder was kept in a thermostat at 55°C for 10 days and the adhesive strength was measured. The results are shown with comparative experiments 1 and 2 in the following table.

| | Combustibility (UL94HB) | Image Quality | | Blocking Test |
|---|---|---|---|---|
| | | Density (O.D.) | Contrast | |
| Experiment 1 | pass | 1.7 | high | good |
| Comparison 2 | failure | 1.7 | high | poor |
| Comparison 2 | pass | 1.4 | low | poor |

Comparison Test 1

The structure of the thermal transfer recorder used for comparison 1 is shown in Fig. 4. The supporting layer (401) is 4 μm thick and it is a PET (polyethylene terephthalate) sheet. The color material layer was made as mentioned in Experiment 1.

Comparison Test 2

The structure of the thermal transfer recorder was the same as that in Comparison Test 1. Only the composition of the color layer was different from that of Comparison Test 1. The composition was shown in the following Table.

| Chemicals | Compositions (wt%) |
|---|---|
| Carnauba wax | 10 |
| Paraffin wax | 40 |
| Ethylene vinylacetate copolymer | 10 |
| Decabromodiphenyl oxide | 20 |
| Antimony oxide | 10 |
| Copper phthalocyanine | 10 |

[Effect of the Invention]

As mentioned above, according to this invention one can add fire retardation effects to the thermal transfer recording medium, and that the layer which is fire retarded is an additional layer beside the color and support layers. Thus, characteristics of the latter two layers are not affected by the addition of a new layer, and the recording medium itself become fire retarded. In other words, this invention can prevent lowering color qualities and rheological characteristics, and lowering thermal and mechanical strengths by an addition of fire retardation additives. Further, the fire retardation layer can play a role of blocking preventatives.

4. Interpretation of Figures

Fig. 1 is a display of a section of the thermal transfer recorder used for experiment 1.

Fig. 2 is a draft of the image quality evaluation equipment used for experiment 1.

Fig. 3 shows a principle for the previous thermal transfer recorder.

301 thermal head.

302 thermal transfer recorder medium.

303 transfer paper.

304 color material part.

Fig. 4 is a section figure for the traditional thermal transfer recorder.

401 supporting layer.

402 color material layer.

403 color materials.

Applicant: Epson Ltd.

K.K. Suwa Seikosha.

Agency a Patent attorney Tsutomu Mogami.

Figure Caption

101 : supporting layer,

102 : color material layer,

103 : layer which contains fire retardation compounds,

201 : supporting layer,

202 : color material layer,

203 : layer which contains fire retardation compounds,

204 : thermal transfer recorder medium,

205 : thermal head,

206 : transfer paper.